Canada.
THE DEPARTMENT OF RECONSTRUCTION

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CANADA'S ROLE IN ATOMIC BOMB DRAMA

Bursting of Atom Opens New Realms to Science, Says Government Statement.

OTTAWA -- "Enquiries received from all parts of the world indicate the widespread interest in the work carried on in Canada in making possible the production of the atomic bomb," said the Hon. C.D. Howe, Minister of Munitions and Supply and Reconstruction, here today.

"The dropping of the first atomic bombs is, however, the culmination of the work of scientists from many nations, the pooling of the scientific and natural resources of the United States, Britain and Canada and the expenditure of hundreds of millions of dollars in the United States and smaller, but substantial, sums in Canada on plant and equipment in the most extensive scientific effort ever directed towards the attainment of a new weapon.

"Having ample supplies of basic materials, good water supplies, and isolated sites well suited to the work, Canada, with foresight and enterprise and the organization of the National Research Council, has been able to enter as a pioneer into an important new field of technology. The future will disclose the full peacetime potentialities of this remarkable new source of energy.

"Interest in the scientific aspects of the achievement is such that after consultation with Dr. C.J. Mackenzie, President of the National Research Council, it has been decided to make public the following details:

LARGE LABORATORY ESTABLISHED IN MONTREAL

Canada has been associated with scientific development in this field since the time when Rutherford began his investigations on Radioactivity in McGill University in 1899. Investigations were, however, confined to university laboratories until the outbreak of war in 1939. From that time, the interests of scientists working on this subject in Britain, the United States, Canada and France were directed to the possibility of a practical application. On the fall of France, French scientists working on the problem were sent by Professor Joliet to join the British scientists. In October, 1940, information on this and other war research was interchanged between Britain, the United States and Canada. Towards the end of 1942, the British proposed that an important section of the work should be carried on in Canada as a joint enterprise. Accordingly a joint laboratory of United Kingdom and Canadian staff was established in Montreal under the administration of the National Research Council. This laboratory has now grown to a staff of over 340, by far the largest organization ever created in this country to carry out a single research project.

PLANT AT PETAWAWA

As a result of agreements reached between the three partner governments, the work of this laboratory was closely co-ordinated with the tremendous research activity in this field in the United States. Its work led to the design of a pilot plant for the production of atomic bomb materials, now under construction at Petawawa, Ontario, by Defence Industries Limited, as a part of the combined United Kingdom - United States-Canadian program. A branch of the National Research Council will be established there in close association with the pilot plant to carry out research on the application of atomic energy in war and in industry, and on the use of its products in research and medicine.

The primary material required for the operation of this pilot plant and for its production of materials for atomic bombs is uranium. One of the world's two most important deposits of this substance was discovered by Gilbert Labine near Great Bear Lake in Canada. To preserve this important asset for the people of Canada and to protect the supply for the United Nations, the Dominion Government took over the ownership of the mines and the extraction plant.

BURSTING THE URANIUM ATOM

The possibilities of the release of atomic energy have been known to physicists for some time. The first indications came shortly after the discovery of radium, when Curie found that it generates heat and maintains itself at a temperature some degrees above its surroundings. The source of this heat energy was investigated by Rutherford during his researches at McGill University in the early years of this century when he showed that new kinds of rays were emitted from radium and a few other similar materials. These rays come from the innermost part of the radium atom which is called its nucleus.

In 1919, Rutherford went further and showed that the nucleus of an atom could be made to emit rays by artificial means, releasing energy in the process. In this process, the atomic nucleus expels a small part of itself as a projectile of very high velocity. This is called the artificial transmutation of an atom, because the loss of the small part changes its nature.

During succeeding years, many new methods of disrupting the nucleus were discovered. Among the most powerful was the use of neutrons, a projectile discovered by Chadwick in 1932. A neutron is actually a part of the nucleus of an atom which may be ejected when the atom is transmuted. A neutron expelled from one atom eventually collides with and enters the nucleus of another atom, often producing a transmutation of the second atom.

In these early experiments, the atomic energy was released from single atoms at a time and required special and delicate apparatus for its detection. It was not until 1939 that the discovery of "fission," or bursting of uranium atoms, gave the first hope that it might be possible to release atomic energy on a large scale capable of military and industrial applications. Physicists and chemists in various laboratories throughout the world had been trying to understand the behaviour of the heavy element uranium when it is exposed to neutron rays. Gradually, bit by bit, with careful experimenting they found the explanation. They discovered that the rays caused the uranium atom to split in two. They found that this bursting, or "fission" as it is called, of a uranium atom was over ten million times more violent than the bursting of a molecule of a modern high explosive.

The bursting of a molecule of high explosive is a chemical process -- one of the many chemical processes that are familiar to us, like the rusting of iron and the burning of coal. These processes are brought about by the forces between atoms which are called chemical forces. The bursting of the uranium atom, on the other hand, is caused by forces inside the atomic nucleus, forces enormously stronger than the chemical forces between atoms.

NEUTRON PROVIDES "TRIGGER"

The fission of uranium differs from ordinary atomic transmutation processes. Transmutation involves the ejection of a relatively small part of the atomic nucleus, such as a neutron or an electron. The loss of this part alters the properties of the atom, including its chemical behaviour. In the case of fission, however, the uranium atom splits into two large parts which become two new atoms of chemically different elements, a discovery so surprising that the scientists feared that no one would believe it. In addition, the fission of a uranium atom is accompanied by the expulsion of neutrons. The number of neutrons emitted varies, but lies between one and three. This is a fact of the greatest importance, for it opens up the possibility that the same process of fission can be propagated in neighbouring atoms of uranium. Another important respect in which fission differs from transmutation is that the energy released in the process is many times greater.

The entry of a neutron into the nucleus of the uranium atom is the trigger which sets off the fission process. Since neutrons are also emitted in fission, they are available to act as the triggers for the fission of still other uranium atoms, and thus under favourable conditions, whole chains of fissions can be produced, each fission being caused by a neutron released in a previous fission. In this way the process can be made self-propagating and self-increasing so that what starts as an action affecting only one or two

atoms may, in a short time, affect a large proportion of the atoms in a block of material. In other words, a "chain reaction" is set up. These are the conditions which must be realized if the energy released in these nuclear processes is to be made available on a large scale. If the chain reaction builds up very quickly the energy will be released in a violent explosion as in a bomb; when the chain reaction is controlled the energy may be set free at a steady rate.

MANY DIFFICULTIES OVERCOME

The large-scale release of atomic energy depends entirely on the conservation of the neutrons produced, in other that they can cause still further fissions. If the supply of neutrons is dissipated by losses, the combustion of uranium atoms will die out like a fire that lacks air. Losses of neturons can occur in many ways. Some of them merely escape from the uranium to the outside; others may be absorbed in the uranium itself or in foreign substances. All materials absorb neutrons. Any substance which is present with the uranium competes with it for the available supply of these particles.

Even in uranium itself not all the neutrons absorbed produce fission. in ordinary uranium, as it occurs in nature, there are three kinds of uranium atom which are distinguished by the names U238, U235 and U234 atoms. They have been so named because they are respectively 238, 235 and 234 times as heavy as the lightest kind of atom hydrogen. Almost all of the fission occurs in the U235 atoms but these are only 7/10 per cent of the mixture. The number of U234 atoms is negligibly small. The U238 atoms absorb neutrons freely without producing fission (except to a slight extent when they are struck by neutrons of very high velocity), and unfortunately U238 atoms greatly predominate in natural uranium. In order, therefore, that the reaction shall multiply itself at the greatest possible rate it is necessary to use U235 alone or at least fairly free from admixture with 238.

In a mass of U235, neutrons will be lost mainly by escape into the outer air. The importance of this effect can be reduced by increasing the size of the mass, since the production of neutrons, which is a volume effect, will increase more rapidly with size than the loss by escape, which is a surface effect. It follows that if the explosion is possible it will require at least a minimum mass of material, which is called the critical size. Thus the explosion is very different in its mechanism from the ordinary chemical explosion for it can occur only if the quantity of material is greater than this critical amount. Quantities of the material less than the critical amount are stable and perfectly safe. On the other hand, if the amount of material exceeds the critical value, it is unstable and a reaction will develop and multiply itself with enormous rapidity resulting in an explosion of unprecedented violence. Thus all that is necessary to detonate the bomb is to bring together two pieces of the active material, each less than the critical size, but which when in contact form a mass exceeding it.

The separation of the U235 atoms, which are most useful for fission, from the comparatively inert U238 atoms is extremely difficult. Both kinds are uranium atoms. They have identical chemical properties and therefore no chemical procedure can distinguish between them. Physical methods which depend on the very slight difference in weight must be used for their separation, and very great technical difficulties had to be overcome to develop a method which was satisfactory even on a laboratory scale. To do this on the scale required for production of the amounts of material necessary for an atomic bomb was a most formidable task and demanded a great industrial effort. The separation of the U235 has however been accomplished in the United States.

PLUTONIUM NEW SUBSTANCE

Uranium is not the only substance that is capable of fission. Another fissile material is plutonium. This substance does not accur naturally, but must be prepared by exposing uranium to neutrons. The U238 atoms, which contribute very little to the fission of ordinary uranium, are the ones that are transmuted to become eventually atoms of plutonium. Plutonium, like U235, is

very fissile, and it has the important advantage that it is chemically different from uranium and is therefore easily separated from it by chemical methods.

NEW PLANT PRODUCES PLUTONIUM

The plant which is being built near Petawawa to produce materials for release of atomic energy, will contain uranium and heavy water. When these materials are brought together in certain proportions and in sufficient quantity chains of fissions are set up and large quantities of energy are released from the uranium in a controlled and non-explosive way.

The basic process in the Petawawa plant is the production of fission in uranium 235 by a slow neutron. The fission of a U235 atom releases high speed neutrons; these collide with the heavy water molecules without being absorbed and so they lose speed until they in turn produce fission. In this way a slow neutron "chain reaction" is set up. This results in very large numbers of neutrons being set free. Some of these neutrons are absorbed in the U238 atoms to produce plutonium. Later the uranium can be removed from the plant and the plutonium extracted chemically.

AID IN RESEARCH AND MEDICINE

Other neutrons can be absorbed in materials placed round the reacting uranium. By this means interesting new radioactive materials can be produced in large quantities. The plant will therefore be a source of supply of such materials for the study of chemical and biological processes and for application in medicine.

Some of the energy of fission is released in the form of fast neutrons and energetic gamma radiation. The reacting uranium must therefore be surrounded with a great thickness of material to absorb the neutrons in order to protect the working personnel from injurious effects. The intensity of the fast neutron radiations is much greater than any previously available to physicists and presents great possibilities for scientific research.

INDUSTRIAL POWER SOURCE

The greater part of the energy of fission appears in the form of heat generated in the uranium metal. This heat has to be removed by rapidly flowing water or gas. The metal surface temperatures are too low at present for this heat to be used effectively for the generation of power, but there is a possibility that this limitation may be removed by further work.

RESEARCH COUNCIL DESIGNS PLANT

The design of uranium fission plants presents technical problems entirely different from anything previously encountered in industrial and engineering experience. It requires the combined knowledge and training of experimental and mathematical physicists, chemists and engineers and experts in other sciences. Every important feature of design has been based on difficult calculation, measurement and experiment.

This work has been carried out for the Canadian plant by the Montreal Laboratory, aided by such experience and information from the U.S. project as was authorized by agreement. The laboratory presented the basic data to Defence Industries Limited who have prepared detailed designs for the construction by the Fraser Brace Company.

SCIENTISTS WHO PROBED ATOMIC SECRETS

Research Work Carried on in Canada by Distinguished Group

The largest and most distinguished group of scientists ever assembled for a single investigation in any British country has worked in Canada on the experimental and development work on atomic energy. Canadian scientists and those from abroad who have been engaged in this scientific work have included:

Dr. C.J. Mackenzie	President of the National Research Council, Ottawa.
Dr. J.D. Cockcroft	Cambridge University, England - Director of the National Research Council Laboratory in Montreal.
Dr. E.W.R. Steacie	National Research Council, Ottawa - Deputy Director of National Research Council Laboratory, Montreal.
Prof. P. Auger	Ecole Normale Supérieure, Paris, France.
Dr. H.H. Halban	College de France, Paris.
Dr. G.C. Laurence	National Research Council, Ottawa.
Dr. J.S. Mitchell	Cambridge University, England and Addenbrooke's [illegible].
Mr. R.E. Newell	Imperial Chemical Industries, England.
Prof. F.A. Paneth	Vienna University, Austria and Durham University, England.
Dr. C.B. Pierce	Royal Victoria Hospital, Montreal, Quebec
Dr. G. Placzek	Vienna University, Austria and Cornell University, U.S.A.
Prof. B.W. Sargent	Queen's University, Kingston, Ontario.
Prof. G.M. Volkoff	University of British Columbia, Vancouver, British Columbia.

Also on the list of Canadian scientists on the staff of the Montreal Laboratory on atomic energy:

Mr. W.J. Allan, (McMaster University) of Hamilton, Ont.
Dr. Jeanne L. Agnew, (Queen's University, Harvard University) of Port Arthur, Ont.
Mrs. D. Bate, (Mt. Allison, N.B.) of Ottawa, Ont.
Mr. A.H. Booth, (University of Manitoba) of Vancouver, B.C.
Dr. G.C. Butler, (University of Toronto) of Ottawa, Ont.
Dr. A. Cipriani, (McGill University) of Trinidad and Westmount, P.Q.
Dr. L.G. Cook, (University of Toronto, University of Berlin) of Paris, Ont.
Mr. D.S. Craig, (Queen's University) of Ridgetown, Ont.
Mr. A.J. Cruikshank, (University of Toronto) of Toronto, Ont.
Mr. P. Demers, (University of Montreal, University of Paris) of Montreal, P.Q.
Mr. D.G. Douglas, (University of Saskatchewan) of Melford, Sask.
Mr. D.M. Eisen, (University of Toronto) of Toronto, Ont.
Dr. L.G. Elliott, (Dalhousie University, Massachusetts Institute of Technology) of Bridgetown, N.S.
Dr. S. Epstein, (University of Manitoba, McGill University) of Winnipeg, Man.
Mr. J.M.G. Fell, (University of British Columbia, University of California) of Vancouver, B.C.

Dr. F.T. Fitch, (University of British Columbia) of Vancouver, B.C.
Mr. C.M. Fraser, (Dalhousie University) of Kensington, P.E.I.
Mr. S.C. Fultz, (University of Manitoba) of Winnipeg, Man.
Mr. G.A. Graham, (University of Saskatchewan) of Saskatoon, Sask.
Mrs. L.M. Grassie, (University of British Columbia) of Arden, Man.
Dr. W.E. Grummitt, (University of Alberta, McGill University) of Hanna, Alta.
Mr. E. Guptill, (Acadia University) of Wolfville, N.S.
Dr. T.J. Hardwick, (McGill University) of Montreal, Que.
Mr. J.A. Harvey, (Queen's University) of Saskatoon, Sask.
Mr. E.P. Hincks, (University of Toronto) of Montreal, Que.
Dr. E.G. Hurst, (McGill University) of Montreal, Que.
Miss P. Kerr, (McGill University) Westmount, Que.
Mr. D. Kirkwood, (University of Toronto) Toronto, Ont.
Mr. W.J. Knowles, (Toronto University, McGill University) Toronto, Ont.
Mr. S.A. Kushneriuk, (University of Saskatchewan) Saskatoon, Sask.
Mrs. J. Laird, (University of British Columbia) Penticton, B.C.
Dr. W.R. Legge, (University of Alberta, McGill University) Edmonton, Alta.
Dr. J.G. Machutchin, (McGill University) Granby, Que.
Prof. J.C. Mark, (Toronto University) Windsor, Ont.
Dr. N. Miller, (University of London) Liverpool, England.
Mr. K. Morrow, (McMaster University) Dundas, Ont.
Mr. A.M. Munn, (Queen's University) of Hamilton, Ont.
Mr. N.J. Nieri, (University of Saskatchewan) of Saskatoon, Sask.
Mr. L. Nirenberg, (McGill University) of Montreal, Que.
Mr. J.W. Ozeroff, (University of British Columbia) of Shore Acres, B.C.
Mr. E. Prevost, (Ecole Polytechnique) of Montreal, Que.
Mr. D.S. Russell, (University of Toronto) of Georgetown, Ont.
Prof. B.W. Sargent, (Queen's University and Cambridge) of Kingston, Ont.
Prof. J.W.T. Spinks, (University of London) of Saskatoon, Sask.
Mr. J.D. Stewart, (Queen's University, Leipzig University) of Kingston, Ont.
Mr. B.M. Thall, (University of Toronto) of Toronto, Ont.
Dr. A.L. Thompson, (Bishop's College, McGill University) of Montreal, Que.
Miss A Underhill, (University of British Columbia, Toronto University)
of Vancouver, B.C.
Mr. D. Van Patter, (Queen's University) of Westmount, Que.
Dr. A. Vroom, (McGill University) of Montreal, Que.
Prof. G.M. Volkoff, (University of British Columbia, University of California)
Vancouver, B.C.
Dr. Muriel Wales, (University of British Columbia, University of Toronto),
Vancouver, B.C.
Dr. P.R. Wallace, (University of Toronto, Massachusetts Institute of Technology)
of Toronto, Ont.
Mr. W.H. Walker, (University of Toronto) of Hamilton, Ont.
Dr. L. Yaffe, (University of Manitoba, McGill University) of Winnipeg, Man.
Dr. R.H. Betts, (McGill University) of Calgary, Alta.
Dr. T.W. Boyer, (McGill University) of Saskatoon, Sask.
Mr. R. Cahn, (McGill University) of Montreal, Que.
Dr. A. Cambron, (McGill University) of Sherbrooke, Que.
Dr. M. Cohen, (University of Toronto) of Toronto, Ont.
Mr. A.J. Cruikshank, (University of Toronto) of Toronto, Ont.
Mr. F.T. Fitch, (University of Purdue) of Vancouver, B.C.
Dr. P.E. Gishler, (McGill University) of Calgary, Alta.
Mr. C.R.G. Holmes, (University of Toronto) of Carp, Ont.
Miss M.E. Kennedy, (University of Saskatchewan) of Saskatoon, Sask.
Dr. M.W. Lister, (Oxford University) England.
Dr. K.J. McCallum, (Columbia University) of Saskatoon, Sask.
Dr. L.A. McLeod, (McGill University) of Edmonton, Alta.
Mr. W.A. Mohun, (University of Toronto) of Toronto, Ont.
Mr. G.B. Moses, (Queen's University) of Ottawa, Ont.
Dr. R. Munger, (McGill University) of Saskatoon, Sask.
Dr. S.M. Naldrett, (McGill University) of Edmonton, Alta.
Mr. W.S. Peterson, (University of Alberta) of Calgary, Alta.
Dr. D.S. Russell, (University of Toronto) of Gormley, Ont.
Mr. P.J. Sereda, (University of Alberta) of Edmonton, Alta.
Dr. L. Siminovitch, (McGill University) of Montreal, Que.
Dr. E.W.R. Steacie, (McGill University) of Ottawa, Ont.

Mr. M. Wilk, (McGill University) of Montreal, Que.
Mr. E.E. Winter, (McGill University) of Barbados, B.W.I.
Mr. J.R. Mills, (Victoria University, Manchester) of Trail, B.C.
Mr. C.H. Simpkinson, (Queen's University) of Trail, B.C.
Dr. J.G. MacHutchin, (McGill University) of Granby, Que.
Mr. E.B. Paul, (Queen's University) of Lyn, Ont.
Mr. J.W. McKay, (University of Saskatchewan) of Saskatoon, Sask.

The following Canadian scientists have been working on Atomic Energy problems in association with the Montreal Laboratory:

In the Chemistry Department at the University of Toronto, under direction of Professor F.E. Beamish; Dr. H.E. Bewick, Dr. J.E. Currah, Mr. D.E. Ryan.

In the Chemistry Department at McMaster University, under direction of Professor H.G. Thode; Dr. G. Dean, Dr. H.E. Duckworth, Mr. R.L. Graham, Mr. A.L. Harkness, Mr. R.C. Hawkings, Dr. D.T. Roberts, Dr. S.R. Smith.

In the Metallurgy Department at the University of Toronto, under direction of Professor L.M. Pidgeon; Dr. W.A. Alexander, Dr. A.C. Topp.

In the Department of Mines and Resources - Fuel and Ore Laboratory, under direction of Dr. G.S. Farnham; Dr. R.L. Cunningham, Mr. H.J. Nichols, Mr. G. Ensell, Miss A. McDowell.

The scientists from abroad associated with the Atomic Energy problem and with the Montreal Laboratory include:

Dr. C. B. Amphlett, University of Birmingham, Eng.
Mr. G. S. Anderson, Imperial Chemicals Industries, Eng.
Dr. W. J. Arrol, Imperial College, London, Eng.
Mr. A. F. Barr, Rutherford Technical College.
Dr. S. G. Bauer, Zurich, Switzerland, Cambridge University, Eng.
Mr. D. B. Booker, Cambridge University, Eng.
Dr. W. E. Burcham, Cambridge University, Eng.
Mr. B. Carlson, Yale University, U.S.A.
Dr. H. Carmichael, Cambridge University, Eng.
Dr. P. E. Cavanagh, King's College, University of London, Eng.
Dr. K. E. Chackett, University of Birmingham, Eng.
Dr. J. D. Cockcroft, Cambridge University, Eng.
Mr. S. G. Cohen, Cambridge University, Eng.
Dr. G. B. Cook, Birmingham University, Cambridge University, Eng.
Dr. E. D. Courant, Swarthmore College, University of Rochester, U.S.A.
Mr. T. Cranshaw, Cambridge University, Eng.
Dr. B. Davison, [illegible] College.
Mr. J. Diamond, Cambridge University, Eng.
Dr. J. V. Dunworth, Cambridge University, Eng.
Mr. A. C. English, Durham University, Eng.
Mr. F. V. Fenning, Cambridge University, Eng.
Mr. B. Flowers, Cambridge University, Eng.
Mr. H. F. Freundlich, Zurich University, Switzerland.
Mr. K. D. George, Aukland University, New Zealand.
Dr. C. W. Gilbert, Cambridge University, Eng.
Dr. A. H. C. P. Gillison, Edinburgh University, Scotland.
Mr. D. W. Ginns, Imperial Chemical Industries, Eng.
Dr. B. Goldschmidt, Institut du Radium Universite de Paris.
Mr. M. Goldstein, Brooklyn College, U.S.A.
Mr. H. Greenwood, Imperial Chemical Industries, Eng.
Mr. I. W. G. Gregory, Cambridge, Eng.Dr. J. Gueron, Institut de chemie, Universite de Strasburg.
Mr. R. G. Hanna, Cambridge University, Eng.
Mr. E. G. Harvey, Imperial Chemical Industries, Eng.
Dr. H. G. Heal, Royal College of Science London University, Eng.
Mr. H. G. Hereward, Cambridge University, Eng.
Mr. J. V. Jelley, Birmingham University, Eng.
Dr. N. Kemmer, London and Cambridge Universities, Eng.
Dr. B. Kinsey, Cambridge University, Eng.
Dr. L. Kowarski, College de France, Paris.
Mr. G. C. Lawrence, Cambridge University, Eng.
Dr. A. G. Maddock, Imperial Chemical Industries, Eng.
Dr. A. N. May, Cambridge University, Eng.
Mr. F. M. Milner, Leeds and Cambridge Universities, Eng.
Dr. J. S. Mitchell, Cambridge University & Addenbrooke's Hospital, Eng.
Mr. F. Morgan, University of Durham, Eng.
Dr. A. K. R. Musgrave, University of Birmingham, Eng.
Mr. F. R. Paneth, Oxford University, Eng.
Mr. G. O. Peabody, Cambridge University, Eng.
Dr. B. Pontecorvo, University of Rome, Italy.
Dr. M. H. L. Pryce, Princeton University, U.S.A., Cambridge University, Eng., University of Liverpool, Eng.
Dr. C. Reid, Imperial College, London, Eng.
Dr. H. Seligman, University of Paris, France, Zurich University, Switzerland
Mr. K. Smith, Cambridge University, Eng.
Mr. B. S. Smith, Kings College, London, Eng., University of London, Eng.
Mr. J. Sutton, University of London, Eng., Christ's Hospital
Dr. J. Thewlis, Manchester University, Eng., National Physical Lab.
Mr. N. J. Veall, London University, Eng.
Dr. C. H. Westcott, Cambridge University, Eng., Aberdeen University, Scotland.
Mr. C. N. Watson-Munro, Victoria University College, Wellington, N.Z.
Mr. D. West, Cambridge University, Eng.
Mr. W. J. Whitehouse, Manchester University, Eng.
Mr. G. Wilkinson, Imperial College of Science & Technology, Eng.
Dr. R. Wilkinson, Manchester University, Eng., Water Pollution Research, Dept. of Scientific and Industrial Research.

[illegible] Young, Canterbury University College, New Zealand; Deptartment of Scientific and Industrial Research, New Zealand.
Dr. [illegible] Adler, University of Zurich, Switzerland; University of Wisconsin, U.S.A.
Mr. [illegible] Allen, Victoria University College; Canterbury University College, New Zealand.
Mr. G. J. Fergusson, Aukland University; Victoria University, N.Z.
Dr. E. A. Guggenheim, Cambridge University; University of London, Eng.
Mr. [illegible] F. Hudson, Oxford University, Eng.
Mr. K. D. B. Johnson, Oxford University, Eng.
Mr. H. Preston-Thomas, Bristol University, Eng.
Dr. D. T. Roberts, University of Birmingham, Eng.
Dr. R. Spence, University of Durham; Princeton University; Leeds U[illegible].
Dr. J. F. Steljes, Edinburgh University, Scotland.
Mr. [illegible] Sterry, Oxford University, Eng.
Mr. H. Tongue, College of Technology, Manchester, Eng.
Dr. J. B. Warren, Royal College of Science, London, Eng.
Dr. A. G. Ward, Queen's University, Kingston, Canada; Cambridge, Eng.

BIOGRAPHICAL NOTES

Dr. C.J. Mackenzie whose name is well known throughout this country for the organization and application of the scientific resources of Canada in all phases of our war effort, is Chairman of the War Inventions Board, Chairman of the War Technical and Scientific Development Committee and a member of the Army Technical Development Board. Dr. Mackenzie had been a member of the Research Council for many years while Dean of the Faculty of Engineering of the University of Saskatchewan. He became the Acting President of the Council in 1939 when General McNaughton was granted leave of absence to assume the command of the Canadian forces overseas and was confirmed President of the National Research Council in May of this year. He has received many distinctions including the Military Cross in the last war, several honorary degrees, and is a Commander of the Order of St. Michael and St. George. Dr. Mackenzie is the Canadian representative on the Joint Technical Committee that includes General Groves for the United States, and Professor Sir James Chadwick for the United Kingdom, which has the responsibility of coordinating the work on uranium and atomic energy in Canada in the joint program of the three nations.

Prof. John Douglas Cockcroft has had under his direction the Montreal Laboratory of the National Research Council. He is a Fellow of the Royal Society of London, Jacksonian Professor of Natural Philosophy, University of Cambridge, and Fellow of St. John's College, Cambridge. Born in 1897, Professor Cockcroft has gained a distinguished reputation in Electrical Engineering and research in Atomic Physics at the Cavendish Laboratory in Cambridge. He was associated with Kapitza in the production of magnetic fields with intensities far beyond those previously attained and carried out extensive investigations at extremely low temperatures. Later, with the collaboration of E.T.S. Walton, he was the first to use high voltage equipment for atomic disintegration, which led to their discovery of the transmutation of Lithium and Boron and other light elements, and of the production of artificial radioactivity by the use of such equipment.

In 1935 he became Assistant Director of the Royal Society Mond Laboratory at Cambridge under Lord Rutherford. Since the outbreak of war he has played a very prominent part in war time research in Great Britain, holding in succession the positions of Assistant Director of Scientific Research in the Ministry of Supply, during which he erected emergency Radar Stations round the British Coasts, and Chief Superintendent, Air Defence Research and Development Establishment in the Ministry of Supply, responsible for Army Radar development in the United Kingdom and the initiation of Army Operational Research Groups. During 1940, he visited the United States and Canada as Vice Chairman of the Tizard Mission to initiate full scale collaboration with the United States. He came to Canada in April, 1944, to assume the duties of Director of the Montreal Laboratory.

Dr. E.W.R. Steacie who is the Deputy Director of the Montreal Laboratory, National Research Council, was born in 1900 in Westmount, P.Q. and is of English-Irish extraction. He studied at McGill University and graduated B. Sc. in 1923 and PhD. in 1926. He has held the Royal Society of Canada Research Fellowship and studied at the Universities of Frankfurt on Main, Leipzig, and King's College, London. He was appointed Associate Professor at McGill in 1937 and has been Director of the Chemistry Division of the National Research Council since 1939. Dr. Steacie was elected a Fellow of the Royal Society of Canada in 1935. He has published numerous scientific papers on photochemistry, gaseous combustion, heavy water reactions, etc. During the war, Dr. Steacie has directed the work of the National Research Council Chemistry Division and numerous war projects of importance.

Dr. Pierre Auger, born in 1902, is foremost among the younger generation of French physicists. A former student of the Paris Ecole Normale Supérieure and a professor at the Sorbonne, he attained early fame for his discovery of the "Auger effect", and for his contribution to Cosmic Rays Research. After the fall of France he accepted a visiting Professorship at the University of Chicago and later joined the N.R.C. project, on a mission of the French Committee of National Liberation. A prominent member of the French Scientific Mission in Great Britain, which reopened scientific liaison between liberated France and her allies, took over the important position of Directeur de l'Enseignement

Supérieur in the Ministry of National Education in Paris . recently, after completing his work at the Montreal Laboratory of the National Research Council.

Dr. H.H. Halban led the first group of scientists to arrive in Canada from the United Kingdom and to him fell the task of organising the Montreal Laboratory and recruiting staff. Before their association with the work in England, both Dr. Halban and Dr. L. Kowarski, who has recently joined the Montreal Laboratory, participated in pioneer research on Uranium fission under Professor Joliot in the College de France of Paris. On the fall of France these two French physicists were sent by Prof. Joliot to England with a full account of the work in France and with instructions to cooperate with the British scientists in the joint interests of the allies. Their escape from Bordeaux to England, was accomplished by the Earl of Suffolk who so effectively played the role of the Scarlet Pimpernel in this war in rescuing many people from Nazi controlled France.. They were able to bring with them the greater part of the world's supply of "Heavy water" which the French government had bought from Norsk Hydro Company just before the invasion of Norway. The safe arrival of this material made it possible to prove within a year that the release of atomic energy was feasible.

Dr. George Craig Laurence began the research in the National Research Laboratories on uranium fission in 1940. He was joined in this work the following spring by Prof. Sargent of Queen's University. Dr. Laurence was born in Charlottetown in 1905, graduated from Dalhousie University with Bachelor of Science degree in 1925, and Master of Science in 1927 while holding a National Research Council bursary. He held an Exhibition of 1837 Scholarship in the Cavendish Laboratory of Cambridge University under Professor Ernest Rutherford, receiving a degree of Doctor of Philosophy from Cambridge. Since 1930 he has been a member of the staff of the Physics and Electrical Engineering Division of the National Research Council, having charge of the work in the laboratories concerned with radium, x-rays and strength of materials. He was elected a Fellow of the Royal Society of Canada in 1941. He has carried out research on radiation from radioactive materials, on applications of x-rays and radium gamma rays in industry, and on radiation standardization for medical radiology. In the Montreal laboratory he directs research in general and engineering physics, and the development of special instruments for the operation of the Petawawa plant.

Prof. F.A. Paneth born in 1887 in Vienna, is known for his early researches in the domain of radioactivity and its application to general chemistry. In the course of a career, which called him to professional chairs in Prague, Hamburg and Koenigsberg, he made important discoveries. Paramount among them is that of the free aliphatic radicals, which have later proved of such importance in the interpretation of reaction mechanism in organic chemistry. At the same time Prof. Paneth started a long work on the analysis of meteorites, which was to shed light on the age of these materials from the sky to prove that they do belong to the solar system. Leaving Germany after the accession of the Nazis to power, Prof. Paneth was able to continue his work in England being first associated with the Imperial College of Science, London, and later, with the University of Durham, where he is head of the Chemistry Department. During this period with his British collaborators, he extended his researches on meteorites, and undertook important work on the subject of atmospheric ozone. Prof. Paneth has been George Fisher Baker Lecturer, at Cornell University, Halley Lecturer at Oxford University, Liversidge Lecturer of the Chemical Society. He also gave lectures at the Royal Institution. In addition to numerous scientific papers he has published the following books: Radio-elements as Indicators; Manual of Radioactivity (with G. Hevesy) and The Origin of Meteorites. He is a foreign honorary member of the American Academy of Arts and Science.

Dr. George Placzek was born in Bruenn, Czechoslovakia, in 1905, received his Ph.D. at Vienna in 1928, carried on his scientific work in theoretical atomic and molecular physics (in particular the theory of Raman spectra) at Utrecht, Leipzig and Rome in the period 1928 - 32, and worked as a member of the distinguished and productive group of Professor Niels Bohr's associates at Copenhagen between 1932 and 1938. This group was, in pre-war years, one of the

world's most active centers of nuclear physical research and the training ground of many of the present recognized authorities in this field. Dr. Placzek came to the U.S. and joined Cornell University staff in 1939, and left there to come to the Montreal Laboratory in 1942. He organized the Theoretical Physics Division of the Montreal laboratory and was its Head until his transfer to another location in May, 1945.

Professor B. Weldon Sargent has supervised the section of the Montreal Laboratories that is engaged in research in nuclear physics. Before joining the Montreal laboratory in 1942, he had collaborated during the summers of 1941 and 1942 in the work on uranium fission in the National Research Council Laboratories in Ottawa. Prof. Sargent, who had been released by Queen's University to participate in uranium work, was born in Williamsburg township, Ontario, in 1906. His university career brought him the Medal in Physics on his graduation with the degree of Bachelor of Arts in 1926. He held an N.R.C. bursary in 1927-28, obtained his Master of Arts degree from Queen's University in 1928. He held an Exhibition of 1941 Overseas Scholarship in the Cavendish Laboratory, Cambridge from 1928 to 1930, and received the degree of Doctor of Philosophy from Cambridge University in 1930. Since then he has been a member of the teaching staff of Queen's University. Dr. Sargent was elected a Fellow of the Royal Society of Canada in 1941. He has made important contributions to the knowledge of the behaviour of the beta rays emitted by radium and similar substances, and is perhaps best known for his discovery of an important principle connected with the emission of beta rays which has been called "Sargent's Law".

Professor George Michael Volkoff is directing the theoritical and mathematical work of the Montreal Laboratory of the National Research Council. His services have been lent to the project by the University of British Columbia. Prof. Volkoff was born in Moscow, Russia in 1914 but moved to Canada with his family in 1924 and became naturalized as a Canadian citizen on reaching the age of twenty-one. He was educated in the public schools of Vancouver and continued with high school in Harbin, Manchuria, where his father was Professor of Engineering in the Polytechnical Institute. He returned to Canada in 1930 to the University of British Columbia, receiving the degree of Bachelor of Arts with the Governor General's Gold Medal in 1934 and degree of Master of Arts in 1936. He obtained the degree of Doctor of Philosophy in 1940 in the University of California. During this period he was engaged in theoretical research at Princeton University on the forces within the nucleus of the atom which are responsible for the energy released in radioactivity and in uranium fission. Later he continued the study of nuclear forces at the University of California with particular interest in the atomic constituents of heavy water.

Mr. Ronold Edward Newell under whose direction the basic engineering design of the Petawawa plant was carried out in the Montreal laboratories was born in England and educated in the University of Cambridge, graduating in 1926. He was associated, in England, with Metropolitan Vickers from 1927 to the end of 1928, and from then until he came to Canada in 1942 was a member of the staff of Imperial Chemical Industries. In 1942 he joined the Montreal Laboratory, of National Research Council. He had, however, been connected in a consulting capacity with a uranium research project in England the previous year. During his association with Imperial Chemical Industries he was responsible for the design of gasoline plants and ammonium plants in England and his designs have been copied even on this continent. In fact, he had visited Canada on a previous occasion to assist in the installation of the ammonium plant of Consolidated Smelters Corporation, Calgary, which is based on his design.

Surgeon-Commander C. B. Pierce, R.C.N.V.R. is head of the Medical Section of the Montreal Laboratory of the National Research Council. His department is engaged in research on the effects of radiation on living materials and in the application in medicine of radioactive materials which will be made in the Petawawa uranium fission plant. Dr. Pierce was born in [illegible] in Elgin, Ill. He graduated with the degree of Doctor of Medicine in the University of Michigan Medical School in 1924 and served as an Intern and Assistant Resident Physician in Roentgenology in the University Hospital in the University of Michigan in 1928. He held the chair of Associate Professor of Roentgenology at the University of Michigan until 1938 when he came to Canada as Director of the Department of Radiology and Radiologist-in-Chief of the Royal Victoria Hospital, Montreal. He is also Consulting Roentgenologist to the Montreal Neurological Institute and the Children's Memorial Hospital in Montreal. He has published many scientific papers on the application of X-rays and radium in medicine. He joined the Royal Canadian Naval Volunteer Reserve in 1942 and now holds the rank of Surgeon-Commander and the position of Consultant Radiologist to Director General Naval Services, R.C.N.

Dr. J. S. Mitchell is associated with Surgeon-Commander C. B. Pierce at the Montreal Laboratory of the National Research Council in directing research on the applications in medicine and biological research of radioactive materials obtained by the fission of uranium. Dr. Mitchell is the Medical Officer in Charge of the Radiotherapeutic Centre, Addenbrooke's Hospital, Cambridge, England, and is also a Fellow of St. John's College, Cambridge